Simulation Studies of Satellite Laser CO2 Mission Concepts

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Results of mission simulation studies are presented for a laser-based atmospheric CO2 sounder. The simulations are based on real-time carbon cycle process modeling and data analysis. The mission concept corresponds to ASCENDS as recommended by the US National Academy of Sciences Decadal Survey. Compared to passive sensors, active (lidar) sensing of CO_2 from space has several potentially significant advantages that hold promise to advance CO_2 measurement capability in the next decade. Although the precision and accuracy requirements remain at unprecedented levels of stringency, analysis of possible instrument technology indicates that such sensors are more than feasible. Radiative transfer model calculations, an instrument model with representative errors, and a simple retrieval approach complete the cycle from "nature" run to "pseudo-data" CO_2. Several mission and instrument configuration options are examined, and the sensitivity to key design variables is shown. Examples are also shown of how the resulting pseudo-measurements might be used to address key carbon cycle science questions.